

Assessing Videoconferencing as a Method of Remote Consultation in Pediatric Dentistry

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ABSTRACT

Background: The oral health condition in rural areas remains compromised due to insufficient healthcare providers. Implementation of teledentistry through videoconferencing in these areas can improve this situation when trained personnel are able to carry out real-time consultations of the patients with a pediatric dentist.

Aim: To observe the feasibility of using teledentistry for an oral examination, consultation, and education, and also to assess the participant's satisfaction regarding the use of teledentistry for a routine dental checkup.

Materials and methods: An observational study was carried out with 150 children aged 6–10 years. About 30 primary health centers (PHC)/ Anganwadi (AW) workers were trained to perform the oral examination with the intraoral camera (IOC). Four self-constructed and nonstructured questionnaires were prepared to understand the knowledge, awareness, and attitude of the participants toward pediatric dentistry and their acceptance of teledentistry.

Results: A total of 83.3% of children were not scared and felt that the use of IOC was better. About 84% of the PHC/AW workers found teledentistry very convenient, easy to learn, and adapt. And around 92% thought that teledentistry is time-consuming.

Conclusion: Teledentistry is a possible way to provide pediatric oral health consultation in rural areas. It can save time, stress, and money for people in need of dental treatment.

Keywords: Digital technology, Remote consultation, Telecommunication, Teleconsultation, Teledentistry.

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INTRODUCTION

India, the seventh-largest country in the world, is classified as an emerging and developing country. It covers a total area of 3,287,263 km² with 83.3 crore population residing in rural areas. According to research conducted by Yakana, it was found that 69% of the Indian population lives in rural areas where there is a scarcity of primary healthcare.¹ In spite of several strategies and policies executed by the government, there are still deficiencies and inequalities in providing health services between rural and urban areas.² The reasons may be many, like lack of public transportation, insufficient healthcare workforce, patient noncompliance, unreliable internet connectivity, and improper implementation of healthcare strategies.³

Apart from general health, oral health, especially in children, is even more compromised as there is a big lacuna in the absence of early detection and regular oral screening programs. Delivering oral healthcare facilities to rural areas is challenging, and a major barrier is a distance and lack of access to a pediatric dentist.

In the recent technologically driven era, one field where rural areas are not far behind their urban counterparts is the telecommunication sector. Estai et al. in 2018 demonstrated that with access to broadband internet and mobile devices, a potentially viable alternative could be created to address the geographical barriers and uneven distribution of oral healthcare through the application of teledentistry.⁴

Teledentistry is an innovative field that has united information technology, telecommunication, digital imaging, and dental practice for consultation, oral health-related education, and creating awareness among people. It has helped connect the

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underserved population in remote areas by providing long-distance clinical oral health care.⁵ The United States Army was the first to practice teledentistry through a project named “Total Dental Access” project by the United States (US) Army in 1994. Later, the term “teledentistry” was first used by Cook in 1997, who defined it as “the practice of using videoconferencing technologies to diagnose and provide advice about treatment over a distance.”⁶

Literature on teledentistry revealed that there are very limited studies regarding the application of teledentistry worldwide in the public domain. A systematic review by Marino and Ghanim on teledentistry found that most of the studies were conducted in the US and Europe, and very few were done in developing countries.⁷ Various articles presented that the scope of teledentistry is vast and has been successfully applied in various specialties in dentistry. Mallick et al., in 2016, described the application of teledentistry in oral surgery, pediatric dentistry, oral medicine,

orthodontics, endodontics, and prosthodontics for consultation and referral.⁸ In a study done by Pentapati et al. in 2017, high reliability of IOC in the screening of oral diseases in children was found. Similar results in the screening of caries in children were observed by Subbalekshmi et al. and Purohit et al.^{9–11}

The real utility of teledentistry would be if children residing in remote areas could get a consultation from pediatric dentists for a routine examination, as well as in acute conditions, such as trauma, pain, or swelling. Health services in rural India are mostly delivered through the PHCs. This center serves as an individual's first level of contact with the national health system and aims to provide preventive and curative healthcare services. There are no posts for dental surgeons at PHCs and consequently, there is no provision for oral health care for the rural regions where the majority (68.8%) of the Indian population resides. Moreover, oral health care has not been integrated with national or community health programs in a number of countries, including India.¹¹ It would be desirable to impart basic consultation, awareness, and education of pediatric oral health in remote areas through the PHC workers.

Thus, this short study was planned to assess the feasibility of using teledentistry through PHC/AW workers for pediatric oral health consultation and screening by using IOC in rural areas.

The main aims of this study are as follows:

- To observe the feasibility of using teledentistry for an oral examination, consultation, and education of 6–10-year-old children in rural areas of Modinagar with pediatric dentists located in a distant setting.
- To assess the participants' [children and healthcare workers (HCW)] satisfaction regarding the use of teledentistry for a routine dental check up.

MATERIALS AND METHODS

Study Design and Sample Selection

This was an observational study to check the feasibility of the application of teledentistry for the oral screening of children in rural areas of Modinagar. The study was planned to be conducted in dental camps, which were organized in collaboration with PHC/AW situated in these areas. It was conducted between 1st December 2018 and 31st January 2019.

A convenience sample of 150 children in the age-group of 6–10 years, living in villages having a PHC/AW with or without dental issues and willing to participate in the study was selected. A total of 30 PHC/AW workers were also chosen and trained to perform the oral examination with the IOC.

About four self-administered questionnaires were prepared. They were nonstructured, each having five simple questions to understand the knowledge, awareness, and attitude of the participants toward pediatric dentistry and their acceptance of teledentistry. The questions had multiple choice answers as yes, no, and maybe. Two questionnaires were given to the children and two to trained personnel, both before and after the teledentistry screening procedure. The children were assisted by their parents in filling up the answers.

Procedure

In the first step, villages having a PHC/AW were contacted and the first 15 villages that were willing to participate in the study were listed. PHCs are rural health care facilities, and AW is a rural child and mother care centers, as part of the Integrated Child

Development Services program, where the workers are trained to provide reproductive and child health services to the community.

From each village, two people, either a PHC or an AW worker (whoever was available and consented), was given the questionnaire before the initiation of any training. After this, they were trained to manipulate the IOC and were briefed on how to perform a real-time consultation with the pediatric dentist at the Institute of Dental Studies & Technologies Dental College and also how to forward the captured pictures for immediate assessment. After the training was found to be satisfactory, the dental camp for children was set up at the most convenient date.

The children were asked to be accompanied by a parent/guardian to assist in filling up the questionnaire prior to the examination. A basic registration of the participants was created, which included a unique identity, name, age in years, and gender.

An oral examination was conducted by drying the teeth with the help of a gauze and disposable wooden ice cream sticks were used to retract the cheek, tongue, and lip for clear visualization. Waldent IOC (Waldent Innovations Pvt Ltd., New Delhi, India) was used for capturing hard tissue images. It had a 5-megapixel lens and an inbuilt light-emitting diode light, with a focus range of 5–50 mm and an automatic focusing quality. The wand-like design of the camera made it child-friendly in appearance. The IOC was connected to the laptop via a universal serial bus connection. The IOC was then focused on the teeth, and a minimum of five clear images per child were captured (front, right lateral, left lateral, upper occlusal, and lower occlusal views). Following this, the data of each participant were then directly forwarded to the pediatric dentist.

The type of teledentistry method used in the present study was the real-time consultation method through live videoconferencing using Skype. Live videoconferencing was carried out between the children/parent and the dentist. Oral hygiene instructions were given and the child's IOC photographs were viewed. A provisional assessment was done and an evaluation was carried out as to whether a referral to the hospital was required. The parents were educated on managing various dental emergencies and first aid management of dental trauma that can occur at home while the child engages in playful activities.

Post-teledentistry session, the questionnaires were again distributed and children were made to fill them again.

Statistical Analysis

The collected data was compiled, organized, and analyzed in terms of frequency (yes, no, or maybe) using Microsoft Office Excel version 10 and the percentage was calculated.

RESULT

A total of 150 children aged 6–10 years, comprising 83 girls (55.3%) and 67 boys (44.6%), formed the study sample. About 30 PHC/AW workers were also enrolled to assess the applicability of teledentistry in rural areas.

Table 1 shows the past dental experiences of children and their attitude toward teledentistry before the examination. It was found that more than half of the children (64%) had never visited any dentist before, though almost half of them (53.3%) had experienced dental pain. A vast majority (77.3%) of the children were scared of visiting a dentist for a checkup. A larger part (85.3%) of the children did not have any problem if someone used a camera inside their mouth to take pictures. Most of the children (56.6%) were unsure when asked about their preference for going to a dentist for a visit or using IOC for a checkup.

Table 2 displays the post-teledentistry questionnaire result of children. After teledentistry screening and consultation was completed, it was found that a majority (83.3%) of the children were comfortable with dental checkup performed by IOC. When asked about the clarity of instructions given by the person taking the picture and the instructions given by the dentist from the computer, 86% of the children understood the instructions given by the person taking the picture, and 86.6% of the children understood the instructions given by the dentist from the computer. A total of 83.3% of children were not scared when examined using IOC, and most of the children (84%) felt that the use of IOC for examination was better than the routine checkup.

Table 3 assesses the awareness of PHC/AW workers about children's dental health needs. Around 64% stated that there was

no access to dental professionals nearby. Yet, half of the workers thought that children go for regular dental checkups. Most of the HCW (76%) were aware that there is a separate dentist for children, but the majority of the centers (66%) did not have any link up with a pediatric dentist. Also, it was seen that the HCW routinely came across various dental problems in children, like trauma, swelling, or pain.

Table 4 shows the results, which show that most of the PHC/AW workers (84%) found the concept of teledentistry very convenient. About 90% found it easy to learn and adapt to the new technology and 92% thought that teledentistry is time-saving. Most of them (86%) felt that it could be used for the routine checkup of children, guiding parents, and forming an early diagnosis. A majority (88%) of them believed that this new way of consultation could be very useful in managing dental emergencies.

Table 1: Children's past dental experience and attitude toward teledentistry

Have you ever visited a dentist for a dental checkup?		
Yes	No	Maybe
36%	64%	-
Have you experienced dental pain?		
Yes	No	Maybe
53.3%	46.6%	-
Are you scared of going to the dentist?		
Yes	No	Maybe
77.3%	22.6%	-
Would you allow a person to put a camera in your mouth and take some pictures of your teeth?		
Yes	No	Maybe
85.3%	-	14.6%
Do you think it is better to go to a dentist for a regular checkup instead of a camera?		
Yes	No	Maybe
43.3%	-	56.6%

Table 2: Children's response to teledentistry postexamination

Did you like having a camera in your mouth for a dental checkup?		
Yes	No	Maybe
83.3%	16.6%	-
Did you understand the instructions given by the person taking the pictures?		
Yes	No	Maybe
86.6%	14%	-
Did you understand the instructions given by the doctor from the computer?		
Yes	No	Maybe
86%	13%	-
Did putting the camera inside your mouth for a dental checkup scare you?		
Yes	No	Maybe
16.6%	83.3%	-
Do you think that the use of camera for examination is better than going to the dentist in real?		
Yes	No	Maybe
84%	-	16%

Table 3: HCW's awareness toward children's dental needs

Do you have a dental professional posted in your area/PHC?		
Yes	No	Maybe
36%	64%	-
Do you think that the children go for regular dental checkup?		
Yes	No	Maybe
20%	30%	50%
Do you know that there is a separate dentist for children (pediatric dentist)?		
Yes	No	Maybe
76%	-	24%
Does the primary health center have any linkup with a pediatric dentist?		
Yes	No	Maybe
34%	66%	-
Have you ever managed a child with a dental emergency like trauma, swelling, or pain?		
Yes	No	Maybe
84%	-	16%

Table 4: HCW's attitude toward teledentistry postexamination

Do you think the concept of teledentistry was convenient?		
Yes	No	Maybe
84%	-	16%
Do you think teledentistry is an easy way of connecting with a dentist?		
Yes	Yes	Yes
90%	-	10%
Do you think teledentistry is time-saving?		
Yes	Yes	Maybe
92%	8%	-
Do you think it will be helpful to consult a specialist (pediatric dentist) through teledentistry?		
Yes	Yes	Yes
86%	-	14%
Do you think teledentistry can be useful in managing any dental emergencies?		
Yes	No	Maybe
88%	-	12%

DISCUSSION

The present study was conducted with the aim of assessing the feasibility of using teledentistry for screening, consulting, and educating parents/children in the rural areas of Modinagar, Ghaziabad, India, where there is limited access to oral health services.

The results of the present study highlight the big void in access to primary oral health care in rural children in India.

In the present study, 6–10-year-old healthy children were chosen for participation, as this age-group corresponds to the early mixed dentition when children might be facing several dental problems, such as dental caries, traumatic dental injuries, and dental malocclusions.¹² Moreover, children in this age-group are friendly, can converse, and follow instructions appropriately.¹³ Similar age-groups were also considered by AlShaya et al. and Estai et al.^{14,15}

In India, it is not always possible to have a well-qualified dentist in every village, but a PHC and AW are usually present. The workers in these centers are educated and trained in basic health services. Hence, it was thought to include and train them for the study. Well-trained workers can be an asset to society in bridging the gap between rural and urban sectors. Thus, in the present study, PHC/AW workers were included for training to assess their knowledge and attitudes toward dentistry and the teledentistry program. Similarly, in a study conducted by Marino et al. in 2014, nonoral health professionals and teledental assistants (e.g., registered nurses) were trained to manipulate the IOC. Marino et al. have also included three HCW working in community health centers (CHC) for their study, while their attitude toward the program was also assessed.¹⁶ In another study by Kopycka-Kedzierawski et al. in 2006, telehealth assistants underwent training and were the ones who conducted the screening and transmitted the recorded images to a pediatric dentist at the urban site.¹³ In contrast, there are several other studies by Estai et al. in 2020, Bissessur and Naidoo in 2019, AlShaya et al. in 2018, and Pentapati et al. in 2017 where screening was conducted by general dental practitioners.^{9,14,15,17} Not only primary HCW, but general dental practitioners, dental auxiliaries, and nondental assistants like nurses, school teachers, and AW workers can also be trained for the same to provide dental screening in distant, rural, and other inaccessible areas.⁹

Teledentistry can work according to two methods, that is, the store and forward method and the real-time consultation method.⁵ The real-time consultation method was used in the present study. This method gave the opportunity to transfer captured images *via* the internet for immediate diagnosis and also to consult the dentist face to face. In addition, it also gave the dentist the possibility to bridge the gap and create awareness, motivate, and manage the children before their clinical visit. A similar technique was also used by Kopycka-Kedzierawski et al.¹³ Although, on the contrary, T et al. used the store and forward method in which a two-way interactive session cannot occur, photographs are taken, stored, analyzed, and forwarded to the dentist when needed.¹⁰

A major requirement of teledentistry and telediagnosis is good-quality images. For capturing the dental images in the current study, IOC was used. The use of IOC was similar to the study conducted by Marino et al. in 2014, Kopycka-Kedzierawski et al. in 2007, and Pentapati et al. in 2017.^{9,13,16} According to Pentapati et al. in 2017, IOC has been demonstrated as a reliable tool to identify common oral diseases like caries, plaque, calculus, fluorosis, or stains.⁹ In addition, a few advantages of IOC were also suggested, which are repeatability of an image, saving time and

resources, early diagnosis, to motivate, and educating patients. Kopycka-Kedzierawski et al. demonstrated that the use of the IOC was a feasible and potentially cost-effective alternative to a visual, oral examination for caries screening, especially early childhood caries, in preschool children attending childcare centers.¹³ Contrary to this, T et al. in 2017, Estai et al. in 2016, and Alshaya et al. used smartphones for capturing IOC photographs.^{10,14,18} Estai et al. stated that smartphone-based mobile teledentistry is easy to manipulate, inexpensive, and a reliable method for remote screening of dental caries.¹⁸

Alabdullah and Daniel, in 2018, found that teledentistry was comparable to face-to-face examination for oral screening, especially in rural areas with limited access to dental care facilities, and long-term care facilities, including identification of oral diseases, referrals, and teleconsultations.¹⁹

Mallik et al., in 2016, suggested a possible implementation model between the dental colleges with the PHCs and CHCs. Where dental colleges can act as a “hub” for providing teledentistry consultations to a group of remotely located PHCs or CHCs. Relevant data can be obtained by HCW appointed at PHCs and CHCs and transferred to the hubs through e-mail or smartphones, and scheduled consultations can be performed *via* direct videoconferencing.⁸ The present study shows that training and conducting consultations, along with collecting and sending data from rural centers to private dental colleges, is possible and will benefit immensely to the rural population.

Limitations of the present study were reported as the study was conducted with a short sample size among parents with varied literacy levels and socioeconomic statuses. Thus, future studies should focus on engaging a larger sample size to know the actual benefit of teledentistry.

CONCLUSION

The present study concluded with a successful trial of teledentistry as a possible way to provide pediatric oral health consultation in rural areas. Implementation of teledentistry can save time, stress, and money for people in need of dental treatment. Furthermore, the concept of teleconsultation will provide emergency dental consultation when needed. With today's reliable digital and online technologies, it will help bridge the gap and promote distance oral health education and assessment.

Clinical Significance

A child's first interaction online using teledentistry will make him familiar with the dentist and the auxiliaries, facilitates his further visit to the operatory, and increases the chance of cooperation. Also, parents' fear and reluctance to bring their small child to a dentist is reduced by their first consultation through teledentistry.

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